

## Special Review



# Changes in Epidemiological Trends and Rehabilitation Usage in Neurological Diseases in Korea: Parkinson's Disease

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## HIGHLIGHTS

- The number of patients with Parkinson's disease (PD) has increased dramatically in Korea.
- The rehabilitation utilization of PD patients has not changed remarkably.
- Additional efforts are necessary to provide adequate rehabilitation for PD.

## Special Review



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### Conflict of Interest

The authors have no potential conflicts of interest to disclose.

## ABSTRACT

Parkinson's disease (PD) is a neurodegenerative disorder characterized by typical motor symptoms such as resting tremor, bradykinesia, and rigidity, as well as non-motor manifestations, including psychiatric symptoms, autonomic dysfunction, and cognitive impairment. These symptoms induce a marked impact on functional independence in daily activities and quality of life in PD patients. Recent guidelines recommend adequate rehabilitation education and treatment from the early stages of PD, and rehabilitation has become part of standard care for PD. In Korea, the number of patients with PD has more than tripled over 15 years, from 39,265 in 2004 to 125,607 in 2019. However, the rehabilitation usage of PD patients has not changed remarkably, and it remains suboptimal in Korea compared to several developed countries, which have advanced and disseminated guidelines and implemented specialized care delivery systems for PD over the past 20 years. Additional efforts are warranted to provide adequate rehabilitation therapies for PD patients in Korea.

**Keywords:** Parkinson's Disease; Epidemiology; Rehabilitation

## INTRODUCTION

Parkinson's disease (PD) is the second most common neurodegenerative disorder worldwide [1]. As South Korea (hereafter, Korea) is already an aged society and is expected to become a super-aged society by 2026 [2], the number of PD patients is also anticipated to increase rapidly. PD is characterized by typical motor symptoms such as resting tremor, bradykinesia, and rigidity, as well as non-motor manifestations, including psychiatric symptoms, autonomic dysfunction, and cognitive impairment [3]. These symptoms have not only a marked impact on functional dependence in daily living in patients with PD, but also reduce their quality of life [4]. Moreover, as PD progresses, the cost of illness soars dramatically because of the increased use of health care resources, loss of productivity, and requirement for home nursing care, imposing an economic burden on the patients themselves, caregivers, and society [5].

Since PD was reported in "Essay of the Shaking Palsy" by James Parkinson in 1817, PD patients are now able to live longer and healthier lives due to the abundant discoveries that have occurred on a gradual scale [6]. The gold-standard treatment for PD remains levodopa,

which mainly reduces the motor symptoms of PD as a dopamine replacement [7]. As a surgical treatment, deep brain stimulation of the subthalamic nucleus or globus pallidus interna is considered to reduce levodopa-responsive symptoms in advanced PD [8]. In addition, gene therapy, fetal cell transplantation, and stem cells are being tried experimentally. However, despite optimal pharmacological treatment, PD patients suffer from various complications such as levodopa-induced dyskinesia [9] and eventually experience an inevitable decline in physical function and activities of daily living. In recent years, evidence has shown that patients with PD might gain benefits through physical activity and exercise, ranging from the improvement of health outcomes to disease-modifying effects [10]. In line with these findings, the National Institute for Health and Care Excellence guideline of the United Kingdom and the European physiotherapy guideline recommend adequate rehabilitation education and treatment from the early stages of PD, and rehabilitation has become part of the standard care of PD [11,12]. As the number of PD patients increases and the resulting socio-economic burden rises, it is necessary to evaluate the current status of the epidemiology of PD and the use of rehabilitation interventions for PD in Korea. Thus, in this current review, we highlight epidemiological trends and rehabilitation usage for PD in Korea and worldwide.

## EPIDEMIOLOGICAL TRENDS

### Worldwide

The worldwide prevalence of PD is estimated to be 0.3% in general, and it increases steeply with age from 41 per 100,000 in the population aged 40 to 49 years to 107 in those aged 50 to 59 years; 428 in those aged 60 to 69 years; 1,087 in those aged 70 to 79 years; and 1,903 in those over age 80 [13]. The global incidence rates of PD are 37.55 and 61.21 per 100,000 person-years in women and men over 40 years of age, respectively [14]. As age increases, the incidence of PD escalates in both men and women. The incidence in women peaks at age 70–79, whereas it continues to increase until age 80 and older in men.

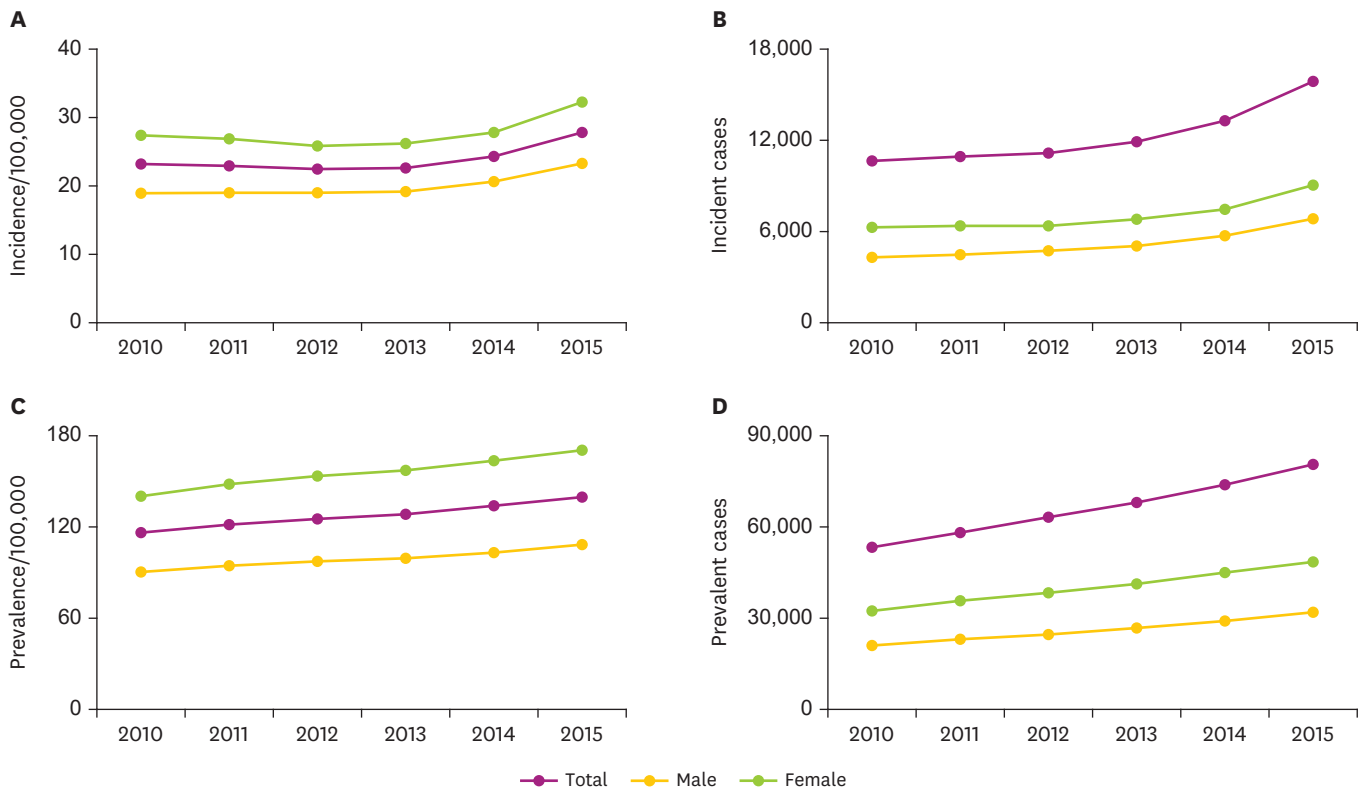
It has been reported that the number of PD patients has more than doubled over the past generation globally: 2.5 million in 1990, compared to 6.1 million in 2016 [15]. From 1990 to 2016, the age-standardized prevalence rate increased by 21.7%, while the male-to-female ratio remained similar (1.37 in 1990 and 1.40 in 2016). The largest increase in prevalence was observed in middle socio-demographic index countries such as Mexico, the Philippines, and Thailand (59.8%). The incidence of PD also continued to increase from 1976 to 2005 (relative risk, 1.35), especially in men 70 years and older [16]. These trends might have complex relations with the growing aged population, reduced smoking rates, and differential exposure to risk factors such as pesticides, head injury, and caffeine intake.

Interestingly, although Asian countries have the highest life expectancies and the largest proportions of aged people in the world, the prevalence and incidence rates of PD are lower than in European and North American countries [17,18]. An epidemiological study of PD in diverse ethnic populations in the same country demonstrated a lower occurrence of PD in Asians and Africans than in Caucasians, Hispanics, and Latinos [19]. However, another study suggested that environmental factors play a role in differences in incidence; for example, the incidence is higher in men of Japanese and Okinawan descent living in Hawaii than in men living in Japan [20]. PD has a multifactorial etiology due to the combined influence of genetic and environmental factors, and the genotype-environment interaction might be an obstacle to distinguishing their relative contributions to the risk of PD development [20,21].

PD is well known to be a male-predominant disease [15]. Its cause is speculated to be related to the effects of estrogen, sex-related genetic mechanisms, or exposure to sex-specific environmental risk factors [20]. However, the male-to-female ratio of PD incidence is lower (around 1.0–1.2) in Asian studies than the ratios of 0.7–2.4 reported worldwide [17]. The incidence and prevalence of PD in Eastern Asian countries, including Japan and Taiwan, are even higher in females [22,23]. Possible reasons have been suggested to include the larger disparities between sexes in life expectancy and smoking rates in these countries [18]. In the future, larger multi-country epidemiological studies are needed to ascertain the contribution of each risk factor to the prevalence and incidence of PD.

**Korea**

A community-based study conducted between 1999 and 2001 in Ansan, Gyeonggi Province revealed that the prevalence of PD was 0.37%, which was similar to the worldwide prevalence [24]. In 2011, the National Health Insurance Service (NHIS) in Korea established a national health information database. The NHIS is a unique health insurance system with a single payer that covers almost the entire population in the country, except for a low-income group corresponding to approximately 3.7% of the population that is covered under the Medical Aid program [25]. The NHIS provides the National Sample Cohort Database, which is constructed from 2.2% of the total eligible population through systematic sampling based on sex, age, region of residence, insurance type, and income. A study using the sample cohort data between 2004 and 2013 reported that the prevalence of PD per 100,000 population in Korea increased steadily from 41.4 to 142.5, and there was an annual increase of 13.2% over the 10-year period [26]. Likewise, a recent study based on NHIS data from the entire population also demonstrated that the prevalence of PD gradually increased (Fig. 1) [27].



**Fig. 1.** Trends in the incidence and prevalence of PD in Korea, 2010–2015. (A) Incidence of PD, (B) incident cases of PD, (C) prevalence of PD, (D) prevalent cases of PD [27]. PD, Parkinson's disease.

**Table 1.** Incidence and prevalence of Parkinson's disease in Korea, 2010–2015 [27]

Year	Total number of individuals ( $\times 10^3$ )	Number of incident cases			Incidence per $10^5$ individuals*			Number of prevalent cases			Prevalence per $10^5$ individuals*		
		Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
2010	50,087	10,606	4,294	6,312	23.2	18.9	27.4	53,519	20,789	32,370	115.9	90.7	140.8
2011	50,362	10,940	4,520	6,420	22.9	18.9	26.8	58,504	22,789	35,715	121.5	94.7	147.8
2012	40,675	11,192	4,755	6,437	22.4	19.0	25.9	63,257	24,718	38,539	125.7	97.8	153.3
2013	50,922	11,897	5,083	6,814	22.6	19.1	26.1	68,292	26,758	41,534	128.5	99.5	157.1
2014	51,187	13,253	5,725	7,528	24.2	20.6	27.8	74,082	29,051	45,031	133.9	103.3	164.1
2015	51,473	15,838	6,787	9,051	27.8	23.3	32.2	80,747	32,002	48,745	139.8	108.4	170.8

\*Age- and sex- adjusted to the 2010 population.

The age- and sex-standardized prevalence was 115.9 cases per 100,000 population in 2010 and 139.8 in 2015 (**Table 1**). These results were similar to those of Japan and lower than those of China and Taiwan when compared using the World Health Organization age-adjusted prevalence [18]. The incidence of PD per 100,000 individuals was 20.2 in 2004 and 53.1 in 2013 in Korea, showing steady growth [26]. The incidence increased in both men and women, and peaked in the age group between 80 and 89 years in 2015 [27]. According to the recently announced Health Insurance Review and Assessment Service in Korea, the number of patients with PD increased 3-fold over 15 years, from 39,265 in 2004 to 76,226 in 2009, 84,771 in 2014, and 125,607 in 2019. The increase in the incidence and prevalence of PD in Korea might be linked to various factors such as the increasingly older population, the growing awareness of PD symptoms, and the rising diagnosis rate of PD.

All regions of Korea except Sejong, which is a new administrative metropolitan city established in 2012, showed an increase in the age-and sex-standardized prevalence and incidence of PD per 100,000 population from 2010 to 2015 [27]. In 2015, Jeonbuk showed the highest prevalence (169.0 cases per 100,000 population) and incidence (38.1 cases per 100,000 population). Policymakers might utilize these findings to provide national health services optimized for local conditions.

As has been reported in other Asian studies, PD in Korea shows a female preponderance. The female-to-male ratio of incidence was 1.4:1 and that of prevalence was 1.6:1 in 2015 [27]. The reasons for this inconsistency with Western populations are uncertain, although this discrepancy might result from the combination of several factors such as genetic susceptibility, exposure to risk factors, and the aging female population.

## REHABILITATION USAGE

### Other countries

The Netherlands has a unique history of rehabilitation for patients with PD. The first evidence-informed physiotherapy guideline with practical recommendations for PD was published by the Royal Dutch Society for Physical Therapy in 2004. It was subsequently updated and adapted into a European guideline, which was finally published in 2014 [28]. Dutch guidelines for speech-language therapy and occupational therapy in PD were also published in 2008 and translated into English in 2011 [29,30]. In addition, ParkinsonNet, an innovative care model for PD, was developed to implement the guidelines within regional community networks of specifically trained allied health professionals [31]. The cost-effectiveness of specialized physiotherapy given via ParkinsonNet has been confirmed by medical claims data analysis [32]. Therefore, rehabilitation for patients with PD is more appropriately provided in the Netherlands than in any other country.

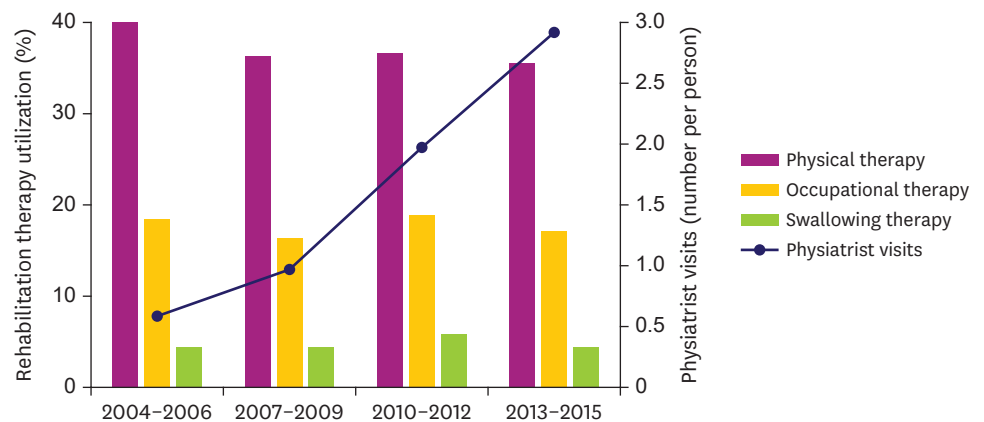
In 2004, before the publication of several guidelines for rehabilitation in PD, the results of a postal survey on the quality and quantity of physiotherapy in PD patients were reported in the Netherlands [33]. Among the 235 patients included in the analysis, 135 (57%) were receiving treatment by a physiotherapist at the time of the study. Twenty-eight (12%) and 26 (11%) patients had been treated by a physiotherapist in the previous year and more than 1 year ago, respectively. One-fifth had never been referred to physiotherapy. Patients with serious problems in core areas (posture, balance, gait, and transfers) showed a slightly higher rate of current physiotherapy usage than those without serious problems (59% vs. 49%). Most patients were satisfied with their present treatment. In 2017, a cost-effectiveness study on ParkinsonNet reported that 58% of patients (4,381 of 7,599) received physiotherapy during the study period. Among them, 49% were treated by a specialized physiotherapist and 51% by a general physiotherapist [32]. Therefore, the rate of rehabilitation usage in PD patients in the Netherlands was maintained at around 60% from the early 2000s to the present.

In contrast, the utilization of rehabilitation therapy services among patients with PD has been reported to be considerably low in the United States [34]. In 2007, only 14.2% of Medicare beneficiaries with PD received physical or occupational therapy, and 14.6% received speech therapy. There was no remarkable change in the rates, with only a small decline for all rehabilitative therapy modalities, from 2007 to 2009. As a result, 75% of patients did not receive rehabilitative therapies over the 36-month period. Care by neurologists, race, and geographic location were predictors of rehabilitation therapy utilization.

In other countries, specific information on rehabilitation therapy use in PD patients is limited. In the Czech Republic, a survey of PD patients from 2013 to 2015 at a single hospital reported that 28% had received physiotherapy prescribed for PD [35]. The authors claimed that implementation of the European physiotherapy guideline for PD and the introduction of an efficient model of care such as ParkinsonNet are needed. The rate of rehabilitation therapy utilization has been reported to be at least 54% in the United Kingdom, although the original text is currently unavailable online [34,36]. The NICE guideline of the United Kingdom, published in 2017, recommended considering early referral of PD patients to experienced physiotherapists, occupational therapists, and speech and language therapists [11]. Recently, an international multicenter prospective study demonstrated that the rehabilitation referral rates at expert care centers for PD were, on average, 34.7% at 4 sites in Canada, 35.3% at 17 sites in the United States, 25.2% at a site in Israel (Tel Aviv Sourasky Medical Center), and 66.7% at a site in the Netherlands (Radboud University Nijmegen Medical Center) [37]. These results suggest that European countries have provided more adequate rehabilitation therapy for PD patients than other countries. The healthcare delivery and reimbursement system, accessibility of rehabilitation facilities, and awareness of medical professionals might be the causes of this difference.

### **Korea**

The Korean government established a registration program for rare, intractable diseases in 2001. This program offers additional co-payment reduction to reduce the burden of patients with rare, intractable diseases, who are required to pay only 10% of their healthcare costs covered by the NHIS. PD has been included in this program since 2004 [38]. Seo et al. [39] reported rehabilitation therapy utilization in patients with PD in Korea using the NHIS-National Sample Cohort Database. PD patients were identified using the registration code for PD in the program for rare, intractable diseases. Among them, 39.8% had claims for physical therapy during a 3-year period from 2004 to 2006. The rates were 36.3%, 36.7%, and 35.5%



**Fig. 2.** Percentages of rehabilitation therapy utilization and number of physiatrist visits in patients with Parkinson's disease in Korea [39].

in 2007–2009, 2010–2012, and 2013–2015, respectively. The proportions of patients who had claims for occupational and swallowing therapies were 16%–19% and 4%–6%, respectively, without remarkable changes during the study period. In contrast, the number of physiatrist visits increased remarkably from 0.58 per person in 2004–2006 to 2.91 per person in 2013–2015 (**Fig. 2**). These rates of rehabilitation therapy utilization were generally higher than those reported in the United States [34]. However, the utilization rate of physical therapy in Korea was around 60% of the rate reported in the Netherlands, which has developed a specialized care delivery system for PD patients [32]. Moreover, the utilization rate of swallowing therapy was 4%–6%, which was much lower than the rate of speech therapy reported in the United States [34]. Although the use of speech therapy was not investigated because it is not covered by NHIS, it is presumed that its utilization rate was very low due to the high cost of speech therapy. Therefore, rehabilitation usage by PD patients does not appear to be optimal in Korea.

This study also demonstrated that sex, age, income, disability grade, and levodopa-equivalent dose were significantly associated with rehabilitation therapy utilization in PD patients in Korea. The associations of age, disability grade, and levodopa-equivalent dose with rehabilitation usage seem to be related to the disease severity of PD. However, the lower rates of rehabilitation utilization in male and low-income patients suggest that access to medical care is still a problem for PD patients in Korea.

## CONCLUSION

An analysis of epidemiological trends showed that the prevalence and incidence of PD have been increasing in Korea, as in other countries worldwide. Given the ongoing aging of the population, this trend is anticipated to accelerate in Korea. However, the rehabilitation usage of PD patients has not changed remarkably and is not optimal in Korea, whereas several developed countries (especially in Europe) have developed and disseminated guidelines and a specialized care delivery system for PD over the past 20 years.

Additional efforts are warranted to provide adequate rehabilitation therapies for PD patients in Korea. First, it is necessary to investigate the current status of rehabilitation usage and to identify obstacles to access to rehabilitation therapies in PD patients. Second, since



the number of physiatrist visits increased dramatically, the lack of rehabilitation facilities, programs, and experienced therapists might be one of the causes of the unchanged rehabilitation usage of PD patients. Therefore, it will also be necessary to establish appropriate facilities, develop rehabilitation programs, and educate medical professionals to provide adequate rehabilitation therapies. Lastly, there is a need for a specialized care model and welfare program suitable for PD patients in Korea to improve access to rehabilitation therapies. Furthermore, considering the evidence for speech therapy and the recommendations of guidelines for PD, speech therapy should be covered by the NHIS for PD patients in the future.

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